

MAR 14 1922

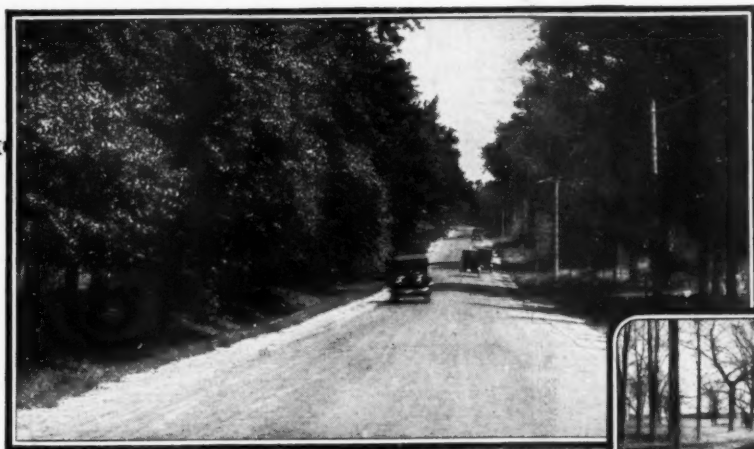
Engineering
Library

PUBLIC WORKS

CITY

COUNTY

STATE



Dundee Road, Elgin Township, Elgin, Ill., Gravel Macadam maintained with "Tarvia-B"



Typical Spring Conditions on a soft-surfaced road

Save the old roads— then on with the new—

Every Spring finds scores of communities inaugurating systematic programs of salvaging the roads already built—putting *them* in shape to handle the growing traffic before new construction is begun.

The economy of such a sound Good Roads program appeals to taxpayers everywhere.

How about the roads in your community? Quite likely the old, worn-out macadam that

you have thought worthless can be quickly and cheaply restored to usefulness by a traffic-proof Tarvia top.

There may be other stretches that need nothing more than the time of a patrol crew to patch them with "Tarvia-KP"—or a simple treatment of "Tarvia-B" to preserve the surface and make it traffic-proof and weather-resisting.

Tarvia roads are mudless, dustless, waterproof and automobile-proof 365 days in the year. Their low first cost and economy of maintenance places good roads and their many advantages within reach of the most modest community.

Illustrated booklets free on request

Tarvia

*For Road Construction
Repair and Maintenance*

New York
Detroit
Salt Lake City
Johnstown
Elizabeth

Chicago
New Orleans
Seattle
Lebanon
Buffalo

Philadelphia
Birmingham
Peoria
Youngstown
Baltimore

Boston
Kansas City
Atlanta
Toledo
Omaha

The *Barrett* Company

St. Louis
Minneapolis
Duluth
Columbus
Jacksonville

Cleveland
Dallas
Milwaukee
Richmond
Houston

Cincinnati
Nashville
Bangor
Latrobe
Denver

Pittsburgh
Syracuse
Washington
Bethlehem

THE BARRETT COMPANY, Limited: Montreal Toronto Winnipeg Vancouver St. John, N. B. Halifax, N. S.

MARCH 11, 1922

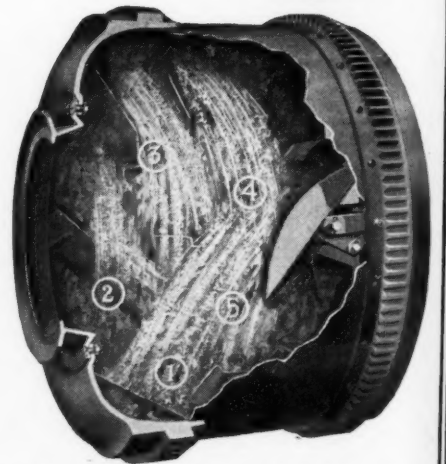
KOEHRING

The
**Heavy Duty
Mixer**



Remixes Concrete

When materials have passed through mixing process once, and come to discharging side of the drum, the reversed discharge chute sprays them back to the charging side for repeated trips through the 5-action, remixing process. This spraying-showering action, at the same time prevents separation of aggregate according to size. To the last shovelful of every batch, Koehring-mixed concrete is uniform, re-mixed concrete—**dominant strength concrete**—and to every last casting and bearing, the Koehring is the heavy duty mixer of trouble-proof, long service life.



(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials hurled across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5), with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

Capacities

Construction Mixers: 10, 14, 21, 28 cu. ft. mixed concrete. Write for Catalog C 14.

Pavers: 7, 10, 14, 21, 32 cu. ft. mixed concrete. Write for Catalog P 14.

Dandies: Light mixer, 4 and 7 cu. ft. mixed concrete; power charging skip, or low charging platform. Light duty hoist. Write for Catalog D 14.

KOEHRING COMPANY
MILWAUKEE WISCONSIN

PUBLIC WORKS.

CITY

COUNTY

STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52

March 11, 1922

No. 10

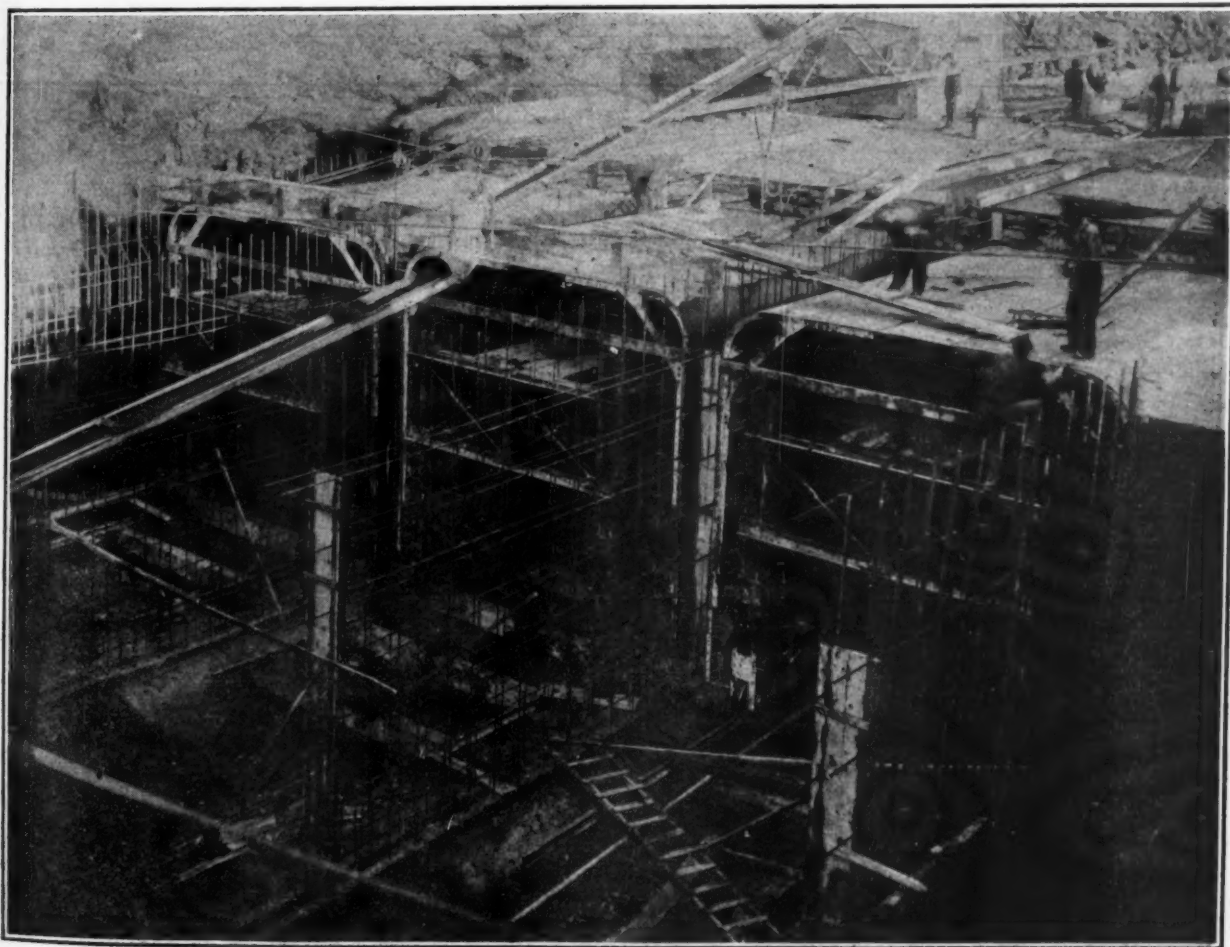
Constructing Conner's Creek Sewer

Mechanical equipment installed for building 7,770 feet of $22\frac{1}{2}$ x 55-foot triple conduit in open trench, using dragline excavator, steam shovel, industrial track and trains, locomotives, concrete mixer plant, and collapsible steel forms, with 375 men.

An important element of the \$35,000,000 sewer system now under construction in Detroit is the Conner's Creek Sewer, about 7 miles long, for which 7,770 feet of $22\frac{1}{2}$ x 55-foot sewer in sections 1 and 2 is now being built by the Gillespie Contracting Co., New York, for a contract price of \$2,190,850. The

contractor, with a force of about 375 men, is now making a progress of about 40 feet daily.

This sewer, which is claimed to be the largest ever built, has an outside rectangular cross section 55 feet, 1 inch in width and 22 feet, 6 inches in height, containing three parallel rectangular barrels 15 feet,



THREE COLLAPSIBLE STEEL FORMS, SET READY FOR CONCRETING.

9 inches inside width and 17 feet, 6 inches inside height, with flat roof, vertical walls, rounded upper corners, and invert concaved on the upper surface to a radius of 16 feet, 6 inches. The thickness of the invert at the center and of the flat roof slab is 22 inches, that of the exterior walls is 23 inches and of the partition walls is 16 inches. The roof and invert are reinforced by transverse bars and, with the vertical walls, are also reinforced by longitudinal $\frac{1}{2}$ and $\frac{3}{8}$ -inch bars, all of them placed at least 3 inches from the surface of the 1:2:4 concrete. All of the 1.970 pounds of reinforcement per linear foot is made of square bars and the shear bars are bent to 45 degree angles. About 14 yards of concrete per linear foot is required.

EXCAVATION

This section of the sewer is built in an open trench involving 250,000 or more yards of excavation in blue clay, which is made chiefly by steam shovels operating in the trench and followed by a Bucyrus dragline machine operating at the surface of the ground, trimming the subgrade just in front of invert construction, and delivering to dump cars on a service track alongside the cut, which transfer the spoil back to the finished structure and dump it there for backfill.

In some places the sides of the trench are protected with steel sheet piling, but in most cases the material is so firm that it will stand safely unprotected with a vertical face and indeed will also support in addition a heavy-surcharge, as is demonstrated by

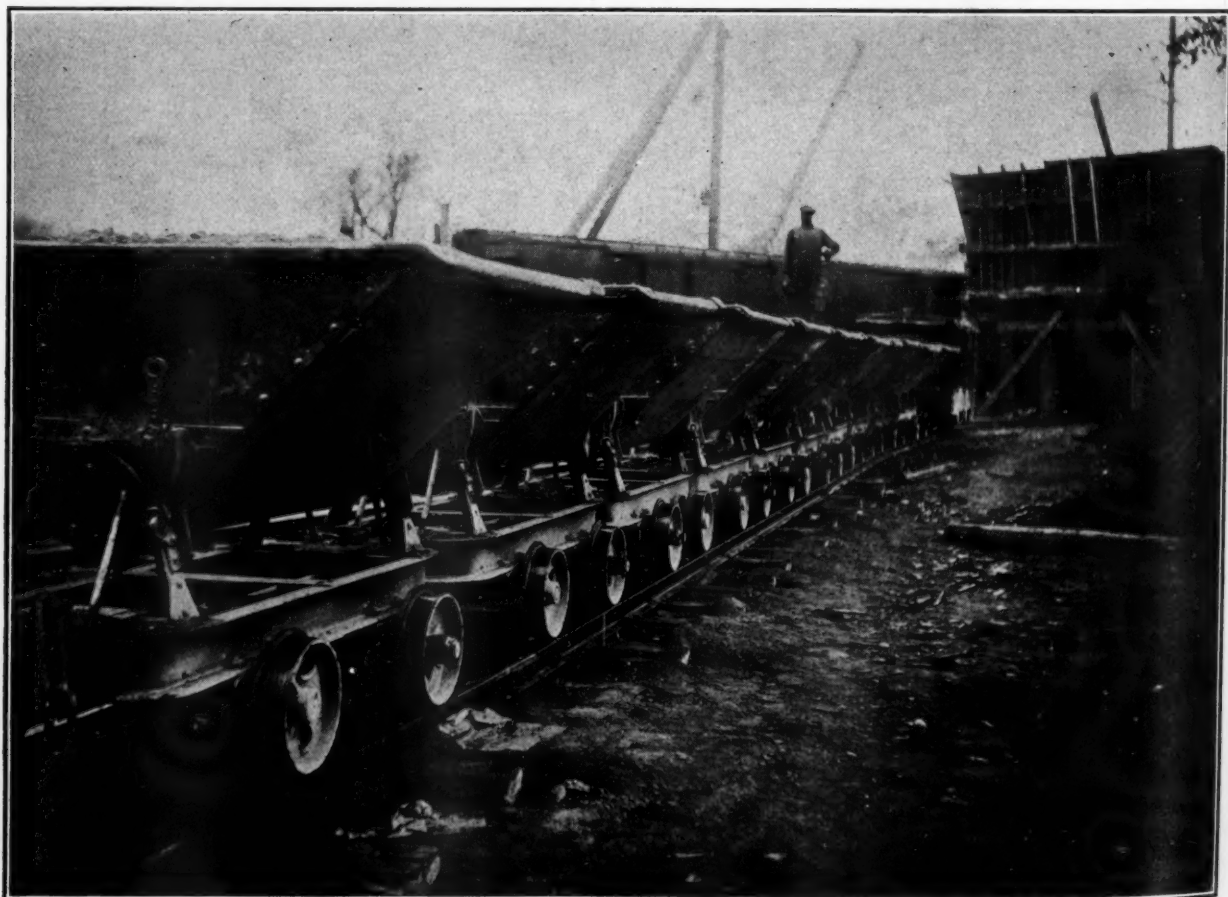
the operation of the massive dragline machine close to the edge of the deep unprotected cut.*

The trench is obstructed by very little transverse bracing. The tops of the sheet piles used in special cases are anchored by wire ropes to dead-men buried in the ground some distance from the trench, and are braced by light, temporary steel struts having rectangular cross sections and built up with four corner angles latticed together on all sides, and set high enough to clear the top of the roof slab.

CONCRETING

All construction materials are delivered by rail to the contractor's yard adjacent to the sewer, where they are unloaded on side tracks and the aggregate is transferred to elevated bins, with five gates through which five cars of a 10-car train are simultaneously loaded and then hauled forward to receive the proper amount of cement from chutes in the cement shed, while the remaining 5 cars are being loaded with aggregate and then in their turn advanced to receive their cement, permitting the train to be loaded with great rapidity. Thirty cradle cars of the Koppel "Ideal" type are used having a capacity of 40 cubic feet and equipped with spring draft gear and double springs, suspended inside cage roller bearings, with cast steel wheels, and transporting 36-foot batches. The cars are hauled by a Burton gasoline locomotive on a 36-inch gage track. For the maximum 1-mile haul a round trip is made in 30 minutes by the 10-car trains. On shorter hauls 6-car

*See front cover, issue of February 25.



DELIVERING AGGREGATE FROM LOADING BIN TO MEASURING DUMP CARS.

trains are used to serve the mixer with an output of 33 cubic yards per hour.

The material cars are dumped directly into the charging hopper of the steam-driven Lakewood mixer installed on the platform of the traveling hoisting tower that moves alongside the sewer trench on a broad-gage track.

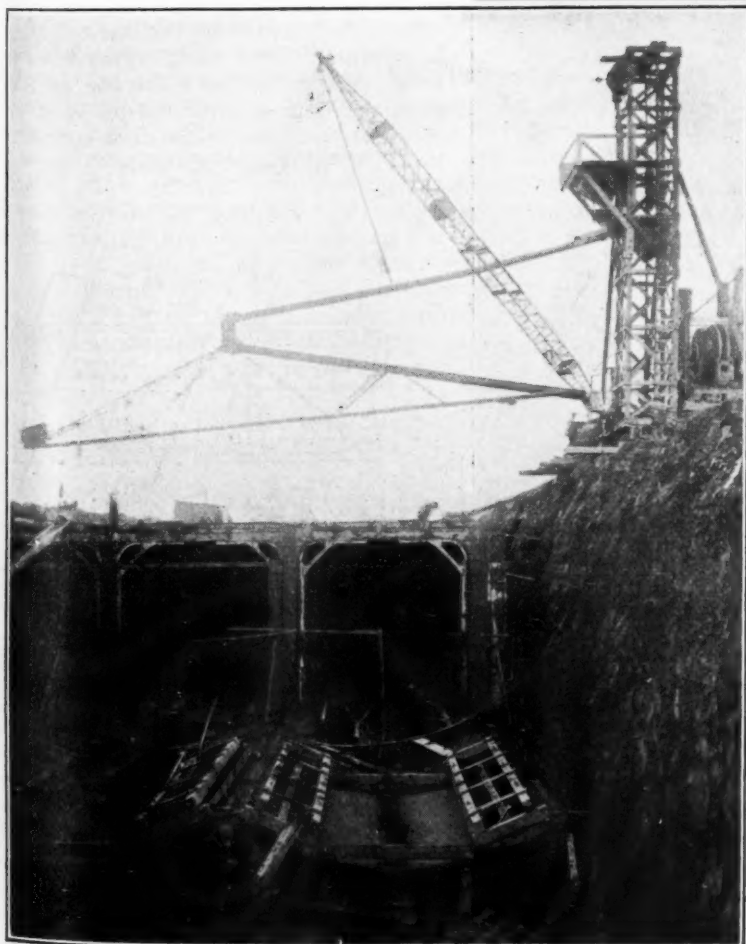
The mixer discharges into a hoisting bucket, which is operated in a wooden tower, braced and guyed to a moving platform, and dumps into a receiving hopper, which serves a revolving steel chute supported by a steel boom, which also carries a counter-weighted truss supporting a second pivoted section of chute. From this second pivoted section the concrete is spouted to receiving hoppers for the terminal chutes, which are suspended by trolleys on overhead cables, which permit the chutes to be quickly shifted to deposit concrete in any part of the trench.

The invert is concreted separately in short sections in advance of the walls and roof, and vertical rods project from its surface to bond with the vertical rods in the side and partition walls. Except on curves, the walls and roof slab are concreted with the aid of six



ABOVE—MOVABLE MIXING AND HOISTING PLANT.

AT THE LEFT—SPOUTING CONCRETE FROM TRAVELING HOISTING TOWER.



sections of Blaw-Knox collapsible steel forms at each of the two points about $\frac{1}{4}$ -mile apart where the work is in progress; one set of three forms being collapsed, scraped, pulled and readjusted while the other set is in service, and the concreting gang is transferred to the opposite section, returning to the first section again and concreting it while a set of forms is being shifted on the other section, and so on, thus affording continuous employment for both the concreting and the form gang.

The steel forms are supported on adjustable inside structural steel towers running on broad gage invert tracks. The forms are shifted after the concrete is five days old. While in service the outside forms are braced against the sides of the excavation. Consecutive sections of the sewer are separated by construction joints made with vertical and horizontal tongue and groove connections and bonded together by horizontal longitudinal bars projecting about 2 feet from one section into the next section.

The alignment is tangent, except for one section of 100-foot radius, one short reversed curve, and two 90-de-

gree curves. In building these curves the steel forms used elsewhere were replaced by ordinary wooden forms having horizontal, longitudinal lagging strips in walls and roof nailed to transverse pieces supported on and braced to interior posts, caps, and struts, all of which are knocked down and removed after the concrete has set sufficiently. At the 90-degree curves the outer faces of the sewer were concreted against the steel sheeting driven there to retain the sides of the trench.

On the tangents a progress of about 20 feet a day is averaged at each of the two points where work is in progress.

Protecting Concrete Bridge Girders from Locomotive Blasts

The Clarendon Street bridge in the city of Boston is a short, wide structure, carrying the street obliquely over the lines of seven tracks of the Boston and Albany and New York, New Haven & Hartford railroads. The bridge has a granite block pavement laid on a reinforced concrete floor slab supported on Bethlehem H-beams and riveted girders, completely encased in a protecting mass of concrete. The concrete enclosing the bottom figures of the girders is continuous from girder to girder, thus enclosing the spaces between the girders and providing a flat ceiled surface underneath them, and only a short distance

above the tops of the stacks of the locomotives that pass beneath the bridge.

In order to prevent the injury of the concrete by the high-pressure locomotive blasts containing sulphur and other injurious elements, the surface of the concrete is protected by cast iron plates, 30 inches by 49 inches and 1-inch thick, provided on adjacent edges with ship lap joints $2\frac{1}{2}$ inches wide with $1\frac{1}{2}$ inch normal overlap, thus making a continuous flush surface and allowing for expansions or irregularities in construction.

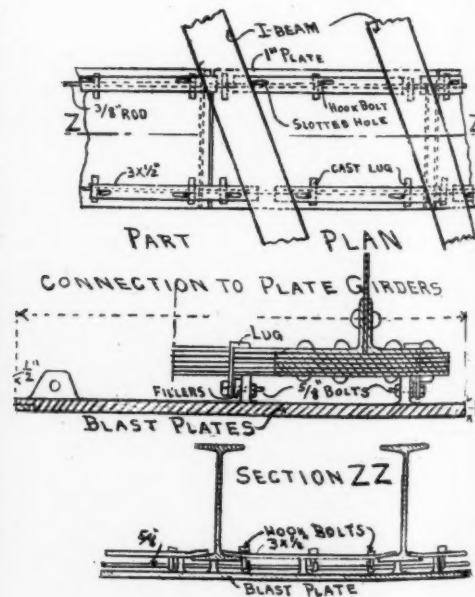
The cast iron plates are provided on the upper side with pairs of lugs 3 inches high, cored for $\frac{5}{8}$ -inch bolts that in some places engage lugs attached directly to the lower flanges of the plate girders. In other cases the holes receive long $\frac{5}{8}$ -inch continuous rods that can be supported at irregular intermediate points by hook bolts passing through slotted holes in $3 \times \frac{1}{2}$ -inch transverse bars supported at their ends on the bottom flanges of the steel beams and girders.

The lugs, rods and bars are all enclosed in the solid mass of concrete that protects the bottom flanges of the girders and is extended to enclose the beam and girder webs, while the cast iron plates form a continuous smooth, durable surface protecting the concrete.

The granite block pavement is laid on a cement and sand cushion under which there is a heavy waterproof coating protecting the upper surface of the concrete floor slab. There is a longitudinal mastic joint one inch thick between the edges of the concrete pavement and the curb, which rises 6 inches vertically above the top of the pavement and is protected by $\frac{1}{8} \times \frac{3}{4}$ inch bar anchored to the curb concrete by $\frac{3}{4}$ -inch staggered bolts 8 inches apart.



BRACING AND ANCHORAGE FOR STEEL SHEET PILES.



METHOD OF SUPPORTING CAST IRON BLAST PLATES FROM GIRDERS WITH CONNECTIONS EMBEDDED IN CONCRETE.

Garbage Collection in St. Paul

By James W. Routh, M.Am. Soc. C. E. *

Discussion of methods, cost and quality of the service in that city. Garbage is collected partly by city and partly by farmers and fed to hogs, with little direct supervision. City collection costs about seven dollars a ton.

The possibility of developing anything to approach uniform and standard practice in the methods of collecting garbage and other household wastes may perhaps be questioned. It is believed, however, that such a possibility does exist, in spite of the fact that this important service is rendered by municipalities with varying degrees of success, at costs ranging widely and by methods which in most cases show little indication of economical development.

If there is any virtue in the interchange of ideas and experiences, then such interchange should by all means be encouraged with regard to refuse collection and disposal. It is certain that by no other process can decision be reached as to the development of principles and practices which may have general application. So long as each municipality stumbles along in its own way with its problem, and so long as the occasional investigations made by engineers in some of the larger cities continue to be made each one without reference to principles which may apply to all, just so long will extravagant and careless methods be the rule. Variations in local conditions are cited too frequently as excusing irregular practices which result in economic losses in addition to costs out of proportion to the character of the service rendered.

With these thoughts in mind, it is proposed to discuss herein the methods, cost and quality of the service in question as performed in the city of Saint Paul. It is believed, as stated, that the problem in any city is one which is capable of scientific analysis; that there are certain more or less fixed principles in connection with it that may profitably be observed by any municipality confronted with its solution.

The discussion of Saint Paul's practice, present and proposed, therefore, is intended to accomplish two purposes:

First, to give information concerning one city's procedure;

Second, to indicate possible principles which may have general application.

GENERAL DATA

The city of Saint Paul, according to the latest census, has a population of about 234,000. It is located in a hilly country and occupies a total land area of approximately 52 square miles. There are about 840 miles of streets, of which 107 miles have hard surfaced pavements and 43 miles are paved with macadam. The remainder are dirt roads, about half of which are wholly unimproved. In addition there are 283 miles of alleys, of which about 6 miles are paved. (These figures do not include pavements

laid in 1921.) The average snowfall, according to the reports of the weather bureau, is 40.1 inches; the annual rainfall is a little more than 27 inches, while the mean temperatures are 25 degrees in winter and 61 degrees in summer. The soil for the most part is sandy, although there is some clay.

Garbage is disposed of in Saint Paul by feeding it to hogs, and by the individual householders burning and burying it. The city does not own or operate a piggery; garbage is fed by a large number of farmers in the vicinity. Some of these men come into the city under license and collect garbage from selected routes, hauling it to their farms outside the city limits. There also are three large piggeries, owned and operated privately, which buy from the city garbage that is delivered to them by collectors employed and paid by the city.

The farmers operating under license, of whom there are 56, pay an annual fee of \$5 for this privilege. Thirty of these farmer collectors have assigned routes in the residential sections of the city and are required to make two collections each week from them. The remaining 26 farmer collectors take garbage only from hotels, restaurants, clubs, etc. It is estimated that approximately 10,000 tons of garbage are collected privately by licensed collectors in the course of a year. No accurate records, however, are available.

The sections of the city not served by the farmer collectors are covered by collectors employed directly by the city. These men work under the supervision of the superintendent of the Bureau of Sanitation in the Department of Public Works. There are, on the average, 32 city collectors who, as a matter of course, collect garbage in those sections of the city where the least desirable conditions obtain; where the houses are widely separated, and where the poorest quality of garbage is found. They also collect, and deliver to the three piggeries contracting for its disposal, about 10,000 tons of garbage per year. It is estimated that, in addition, there are about 3,000 or 4,000 tons of garbage produced each year which are not handled by either city or farmer collectors.

PRESENT METHODS AND COSTS

The city of Saint Paul has been fortunate thus far in being able to have at least half of its garbage collected and disposed of without cost. The 56 farmer collectors, as stated, are estimated to collect 10,000 tons of garbage each year. Actually their routes include about half of the city, according to population, and of course they obtain the richest garbage. The annual license fee collected from these men produces a small revenue and at the end of the present year it will be doubled. This step

*Consulting Engineer, Saint Paul Bureau of Municipal Research.

will be taken in order to give the city authorities a little better control over the men than they now possess.

The garbage which is collected from the 32 city routes, as distinct from the farmer routes, is sold to three piggeries at prices (effective September 1, 1921) of \$0.90, \$1.57 and \$1.02 per ton, respectively. The revenue from this source amounts to about \$12,000 per year and is applied to reduce the cost of the collection service. The latter cost is somewhat high, totaling about \$71,000 during the year.

Until November 1, 1921, the city collectors were paid \$185 per month. For this sum they provide a driver who collects, a team and the running gear of a wagon. The wagon boxes are furnished by the city, and are wooden boxes having a capacity of about three cubic yards. They can be emptied only by shoveling and, of course, are more or less unsanitary, even though well cared for and frequently washed.

On the first of November the collectors accepted a wage reduction of \$25 per month, making the wage rate from that date \$160 per month. This reduction will mean a reduction of nearly \$10,000 in the total annual cost of the service.

For the first seven months of 1921, the records show total deliveries to the three piggeries amounting to 4,346 tons. The cost of collection during that period amounted to \$4,217.14, giving a unit cost of collection of \$9.68 per ton. During July, a month of high collections, there were 954,151 tons collected, at a unit cost of \$6.84 per ton. There are available no accurate records of collections for any period prior to January 1, 1921, hence the unit cost for the year can only be approximated at about \$7.10 per ton; in all probability it will not be less than this, and it may be more, depending upon how rapidly the quantities collected fall off during the last three months of the year. The figure given is net for collection, and does not allow for any reduction on account of revenue from the sale of garbage.

In spite of the fact that this unit cost is somewhat high, the net unit cost for the entire city is quite low. Since half of the total garbage is collected without cost, and a revenue of \$12,000 is received from the sale of part of it, the total net cost becomes about \$60,000 for approximately 20,000 tons collected, or \$3.00 per ton.

QUALITY OF SERVICE

The quality of service for garbage collection is not easy to determine, especially under the conditions which obtain in Saint Paul. It is common practice to accept the number of complaints of non-collection, irregular collection, etc., as being a measure of the quality of service and of the degree of satisfaction of those served. This is believed, however, not to be a fair criterion. The number of complaints can be no true index of the quality of service. There are too many variable factors in the question. Few complaints may mean either unusually good service, or service so bad that householders have become convinced of the futility of repeated complaints. The most satisfactory use of complaints occurs when close supervision is provided over collectors, when the latter are subject to frequent checking up by independent inspectors and when the complaints received are systematically followed up, satisfied and tabulated as a part of the record of the several collectors.

The tabulation of complaints may give the supervising officer, under the conditions laid down, an index of the effectiveness of his inspection service, of the relative reliability of his collectors and of the sections of the city where most educational work is required. The latter is important from many standpoints. The following up of complaints many times discloses conditions pertaining to the house treatment of garbage that prevent or hinder effective service from the collectors. These conditions generally arise through the ignorance of the householders or their failure to appreciate the need for co-operation with the collectors in obtaining regular and satisfactory collection service. Valuable educational work can frequently be done by tactful inspectors in such cases. This, in turn, not only satisfies many complaints but keeps the general public informed of the character of service performed for them and of which they seldom think except to curse for its faults.

In Saint Paul there is little direct supervision over the collectors, and almost no checking up of their work by inspectors. This is especially true of the farmer-collectors, and as a result it is difficult to determine with any degree of accuracy how satisfactory is the service provided. Complaints are received in irregular quantities; most of them, from the records kept, are against the city and not the farmer collectors. On the other hand, it becomes necessary at intervals to discontinue farmer and substitute city collectors on various routes, because of unsatisfactory service from the former. It has been noted also that the farmers are inclined to reduce their collections to a minimum during the period of heaviest garbage, when they may be occupied in harvesting their crops. Some of the farmer collectors, furthermore, have been inclined to give up their routes with the falling prices of pork and corn. These factors, in particular the need for ensuring greater reliability, have all entered into the decision to increase the annual license fee charged the farmer collectors from \$5 to \$10. This, it is believed by the city officials, will tend to eliminate those farmers who are least inclined to collect garbage for hog feed. It is obvious, however, that collection by farmers without cost to the city cannot be depended upon in the future. Before many years have passed all collections undoubtedly will have to be made by collectors employed by the city.

The work of the city collectors, directly under the control of the Bureau of Sanitation, is especially difficult to appraise. The routes served by these men represent the most difficult collection conditions in the city, since most of them have been abandoned by the farmer collectors, who find it profitable to collect only where the ease of collection is relatively high and the quality of garbage the best. Consequently the city collectors serve territory where houses are widely separated, where few of the streets are paved, and where the class of residents is least likely to co-operate in making the collection service good. Hence the fact that complaints of poor service are more frequently lodged against city than against farmer collectors should not be given too much weight. Nevertheless the number of such complaints indicates the need for closer control through inspectors and field supervisors. It is im-

possible properly to control any such work solely from the office, as is now practically the case.

Complaints are received at the office of the Bureau of Sanitation, where they are entered in a daily log. The collectors, as many as have access to telephones, are required to call the office daily and are then notified of complaints from their routes. They are expected to make the collections required in answer to complaints the day following, but frequently fail to do so since there is no further follow-up by the officers of the Bureau. A Ford truck, used in other work mornings, makes special collections on complaint during the afternoons. As a considerable number of the regular collectors either do not have access to telephones, or cannot understand instructions given in that manner, it is evident that chief reliance must be placed on the truck for answering complaints. It is also evident that control over collectors and the handling of complaints in general is not altogether satisfactory. Better results would be obtained if all collectors were reached daily with complaints of non-collections on their routes and were required to answer and satisfy the complaints on the day received. This could be accomplished by providing field supervisors who would be in touch with the office at frequent intervals during the day.

(To be continued)

Notice to Bidders of Possible Change of Highway Location

The following circular letter to contractors has recently been issued by the State Highway Engineer of Missouri:

Re Project No. 105—Sec. A—Iron County

A change in location near Tip Top between stations 200 and 330 is contemplated and if the change is made it will be done during construction.

The contemplated change will probably increase the quantities, and it is requested that you carefully examine this possible relocation before submitting your bid on March 3rd.

Mr. George Mattingly, project engineer assigned to this work, is located at Ironton, Missouri, and has his offices over Adolph's jewelry store. He is equipped with two Ford cars and by applying to him at Ironton he will arrange to show you the contemplated change in location.

We are asking that each contractor submitting a bid for this work sign a statement attached to the bidder's blank, stating that he has carefully examined this contemplated change in location and that his unit prices take into consideration said contemplated change. A bidding blank with this form attached will be provided upon application to Division Engineer H. D. Griffith, DeSoto, Missouri, for plans and specifications.

You will be further advised that any bid in which the unit price for rock excavation exceeds the unit prices shown on the engineer's estimate of cost for same will be considered as an unbalanced bid, and will be rejected.

Jefferson City, Mo., Feb. 15.

Alexander V. Graham,

State Highway Engineer.

In explanation of this announcement the following letter has been addressed to the editor:

Without entering into a discussion of the merits of the policy of arbitrarily limiting bids on certain items of work, a policy which this department has never regularly put into effect, the local conditions in the particular case in hand justify an arbitrary limit of bids on rock excavation, on account of the fact that the engineer's estimate, which has already been published and cannot well be changed at this time, contained only a nominal amount of rock excavation, whereas, the Tip Top relocation, if adopted, will greatly increase the quantity of rock excavation to be done

by the contractor, and the tendency of bidders to place high unit prices on this item might reasonably be anticipated, since the bid is based on the quantities in the engineer's estimate, which contains a relatively small amount of rock.

The circular letter referred to was put out by the department in order to avoid the possibility of being required to reject an unbalanced bid, a procedure which it is always best to avoid, if possible, especially in public work, where criticism of the action of public officials in the matter of letting contracts is always forthcoming upon the slightest excuse.

Very truly yours,

MISSOURI STATE HIGHWAY DEPARTMENT,
Kirk McFarland,

Jefferson City, Mo., Feb. 25.

This notice is discussed editorially in this issue.

Bid Prices for Missouri Road Work

The State Highway Department of Missouri last month awarded to the lowest of twenty-three bidders a contract for building a graded earth road 6.36 miles long and 24 feet wide, and for three bridges between Huntsville and Keytesville. The engineer's estimate, the prices of the low bidder and the highest bid for each item were as follows:

Item	Estimated Quantity	Unit Prices		
		Engineer's estimate	Lowest bidder	Highest bid
Earth excavation.	33,781 cu. yds.	\$.50	\$ 0.26	\$.448
Borrow	20,244 cu. yds.	0.50	.24	.44
Class B, Conc.				
Mas. (1:2:4) ..	333.3 cu. yds.	30.00	18.50	27.00
Class C, Concr.				
Mas. (1:3:5) ..	6.0 cu. yds.	28.00	25.00	28.00
Reinforcement ...	23,681 lbs.	.08	.035	.07
15 in. Cor. Culvert	56 ft.	2.00	2.00	2.20
24 in. Cor. Culvert	40 ft.	3.00	3.00	3.30
Rip-rap	25 sq. yds.	2.50	2.00	2.75
Bridges				
Class B Concrete.	203 cu. yds.	30.00	20.00	27.30
Reinforcing steel .	20,550 lbs.	.08	.035	.07
Temporary trestle	50 ft.	10.00	10.00	10.00
Timber piles	560 ft.	1.25	.60	1.25
Concrete piles....	180 ft.	3.00	3.00	4.00
Class A, concrete				
(1:2:3)	57 cu. yds.	30.00	22.00	55.00
Class B, concrete.	106.5 cu. yds.	33.00	18.00	33.00
Class C, concrete.	50.5 cu. yds.	35.00	24.00	40.00
Reinforcing steel.	15,100 lbs.	.08	.035	.07
Structural steel ..	36,900 lbs.	.085	.054	.095
Gas pipe	313 lin. ft.	.65	.30	.65
Creosoted piles ..	800 ft.	1.75	1.20	1.75
Class A concrete.	1.8 cu yds.	75.00	50.00	75.00
Class B concrete..	111.9 cu. yds.	30.00	20.00	30.00
Reinforcing steel..	5,360 lbs.	.08	.035	.07

The engineer's estimate was made in May, 1921, and his total estimate at that date was \$65,750, while the lowest bid was \$37,734, and the highest was \$55,471. This difference undoubtedly is a result of the fall in prices of materials and labor, apparently indicating that this has been about 40 per cent.

Single-Track Roads in Illinois *

Vermilion County, Illinois, in 1916 designed and has since then completed 210 miles of single-track paved roads, of which 170 miles was constructed by the county itself, 30 miles by townships forming connecting links, and 10 miles by the State. This system reaches into every section of the county, connecting every town with the county seat, and with

*Excerpts from paper by P. G. McArdle, former superintending engineer of Vermilion county, Illinois, before Good Goods Congress.

each other. A considerable accomplishment for a county with a population of 80,000, and an assessed valuation of \$62,000,000.00. Outside of one north and south road (Dixie Highway) and one east and west road, the balance of the system serves every need, and will for many years to come.

All of the single track roads built by the county had gravel or macadam shoulders constructed on each side of the ten foot slab. Of these roads 140 miles were ten foot concrete, and thirty miles were ten foot monolithic brick roads. The State constructed originally ten miles brick road on concrete base, of which somewhat over a mile was double track, of the remainder three miles had macadam shoulders, and five miles without shoulders. This latter was widened to eighteen feet. All of these roads have given satisfactory service.

Rapid Laying of Monolithic Brick Pavement

Section A of the Lincoln Highway in Ashland county, Ohio, is 1.9 miles long and has a 15-foot brick surface on a 5½-inch concrete foundation, involving 10,000 yards of earth excavation hauled a maximum distance of about 600 feet. The alignment is practically level on the old location. The contract price was \$81,000.

The excavation was made with an 18-B Bucyrus steam shovel. The aggregate for the 17,800 square yards of concrete foundation was received in railroad cars, handled by Galion unloaders, and mixed in two 7-B Koehring pavers requiring for their operation a force of about 50 men. The concrete was spouted to position on sub-grade by a pivoted chute, was roughly spread by hand to a thickness slightly above the required depth, and was quickly and economically leveled by a template riding on the forms and chained to the paver that hauled it forward as it advanced. The mixture was comparatively dry and was spread by two men working in advance of the template-scraper.

The paving bricks were stored in piles alongside the road and were delivered to the pavers by a gravity roller conveyor about 18 feet long that was set transverse to the axis of the road and rolled longitudinally on it.

Enough helpers were provided to keep the conveyor continuously supplied with bricks, which it delivered to all parts of the roadway, where the pavers worked at high speed to keep up with the concrete machine, a result they could never quite accomplish. The best bricklaying record was 376 linear feet in one 8-hour day. Work was commenced August 15 and completed October 15, with a total force of about 80 men, who finished the job about 8 months ahead of the required time.

F. J. Mann & Son, Wauwatosa, Wisconsin, was the

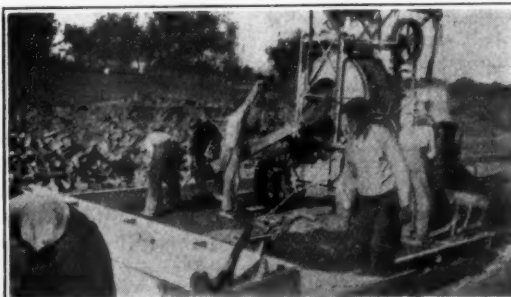
contractor for the work, which was executed under the supervision of Gus Otter, county surveyor, and L. C. Harrick, state highway commissioner. H. C. Mann, of the contractor's firm writes that "the only data we have on the Koehring machines is the time lost with them, which was less than 30 minutes for two pavers for all the season's work, and the repairs were less than \$10 on both machines."

Proposed Hudson River Highway Suspension Bridge

There is now before the New York State Legislature a bill to charter the construction of a highway toll bridge across the Hudson river between Bear Mountain and Anthony's Nose at a point 40 miles above New York City, which would afford the only bridge service across the river below Poughkeepsie, 73 miles above New York. As the bridge would afford direct communication between the popular Palisades Interstate Park and the beautiful drive on the east bank of the river it would doubtless have a large tourist traffic which it is conceded would yield sufficient revenue to make the enterprise an attractive one and yield a handsome profit before the bridge, according to the terms of the charter, reverts to state ownership at the expiration of 30 years or is purchased by the state at any one of previous fixed dates for specified varying sums.

The design contemplates a wire cable suspended structure with a 1,650-foot main span having at least a 22-foot roadway and two 4-foot sidewalks and supported at a clear elevation of 135 feet above the water level by two steel towers at the water's edge with rock foundations.

The proposition includes the construction of nearly 3 miles of approach road connecting with the Albany Post Road and with the State Highway at opposite ends of the bridge and involves fixed tolls of from fifteen cents for pedestrians to \$1.75 for automobile trucks. The project is advanced by the Terry & Tench Co., New York, and their associates who are prepared to build and operate the structure.



LEVELING CONCRETE WITH TEMPLATE
HAULED BY PAVING MIXER
Bricklayers Served by Gravity Conveyor



TWO MEN ONLY, SPREADING
CONCRETE BETWEEN
PAVER AND TEMPLATE

PUBLIC WORKS

Published Weekly
at 243 W. 39th St., New York, N. Y.

S. W. HUME, President J. T. MORRIS, Treasurer

Subscription Rates
United States and Possessions, Mexico and Cuba \$3.00 year
All other countries..... 4.00 year

Change of Address
Subscribers are requested to notify us promptly of change of address, giving both old and new addresses.

Telephone (New York): Bryant 9591
Western office: Monadnock Block, Chicago
A. PRESCOTT FOLWELL, Editor
FRANK W. SKINNER, Associate Editor

CONTENTS

CONSTRUCTING CONNERS CREEK SEWER.	
Illustrated	173
Protecting Concrete Bridge Girders from Locomotive	
Blasts	176
GARBAGE COLLECTION IN ST. PAUL. By	
James W. Routh.....	177
Notice to Bidders.....	179
Bid Prices for Missouri Road Work.....	179
Single-track Roads in Illinois.....	179
Rapid Laying of Monolithic Brick Pavement.	
Illustrated	180
Proposed Suspension Bridge.....	180
EDITORIAL NOTES	181
Heavy Sewer Construction—A Scrupulous Highway	
Department—Mahomet Goes to the Mountain	
Lincoln Highway	176
Taxing Gasoline for Road Work.....	183
METHODS OF PAYING FOR PAVING. Table....	183
RECENT LEGAL DECISIONS.....	184

Heavy Sewer Construction

The construction of the \$35,000,000 combined sewerage system in Detroit to serve an area of more than 80 square miles and an estimated population of 2,500,000 is now well advanced and includes some notably large and heavy work of which the three-barrel 55x22-foot conduit is the largest or among the largest ever built. About a mile and a half of this great structure is being built by the open cut method in a trench excavated in stiff blue clay by low-level steam shovels and a heavy high level drag-line machine that practically eliminate hand work and continuously deliver large quantities of material to dump cars hauled by steam locomotives.

Concrete materials are loaded by gravity from elevated bins to batch cars hauled by locomotives to the travelling concrete plant that delivers directly to the forms with a high degree of efficiency.

A complete cycle of operations is carried on at each of two separate points and an excess number of collapsible steel forms are provided allowing an alternation of work to permit the concrete to harden that secures continuous operation as the gang shifts back and forth.

The liberal equipment of costly power plant in-

stalled, careful planning and co-ordination of operations and the employment of a force of 375 men has secured a profitable efficiency enabling the contractor to earn approximately \$11,200 per day on tangent construction.

A Scrupulous Highway Department

A practical desire to exercise even-handed justice between the state and the contractors and to warn the latter in advance against speculative bids, is shown in a recent circular letter addressed by Alexander Graham, State Highway Engineer of Missouri, to bidders on project No. 105-Section A Iron County, wherein he advises them of a contemplated change in location, urges personal inspection of the proposed route, offers transportation and official conduct to bidders visiting the site and encloses a blank, to be attached to the bid, stating that the bidder contemplates change of location in fixing his unit prices.

Such a frank and practical way of insuring the contractors' attention and full appreciation of the character of the work to be executed, is certainly an agreeable act that strongly tends to inspire confidence and satisfaction and should go far to stimulate trust and promote reciprocal frankness and good faith. When a specification is supplemented in this extra-legal manner there should be little need to fear any hidden jokers, unfair clauses, misleading paragraphs, or ambiguity.

Restricting Unit Prices

The notice above referred to, however, although it is obviously intended to be a fair announcement of policy and to draw impartial limits for the bids, does not propose a procedure that appears to be generally commendable, even though in the present case it may be justified. In it bidders are specifically warned that "any bid in which the unit price for rock excavation exceeds the unit price shown on the engineer's estimates of cost for same, will be considered as an unbalanced bid and will be rejected."

Judging from the explanation appended, which was made in reply to our inquiry, the special local conditions and the exigencies of the case warrant this unusual restriction of bids, but in a general way that restriction is not in harmony with the broad principles of open public competition, and if often applied would be likely to work to the disadvantage of the public and the contractor, and might discredit the estimate.

The limitation of unit prices must inevitably be a delicate and probably complicated matter that would be strongly opposed, but possibly might be desirable if all unbalancing of bids could thus be prevented. It is, however, probable that as many bids have been essentially unbalanced against the interests of the contractor by reason of arbitrary, unexpected or unavoidable changes in conditions, quantities, classifications and interpretations, which he was powerless to prevent, as have been made in his favor by manipulations of unit prices.

If the price restriction can be made perfectly fair and its principles extended to all the features of the contract it would probably not be subject to as much adverse criticism, but it seems doubtful if this is possible, and even if it were, the method taken to

secure the desired results seriously impairs the flexibility which is an essential of any satisfactory contract other than one based wholly on absolutely predetermined knowledge, accuracy and stability of conditions, quantities and other features.

There are several serious objections to arbitrary limiting of unit prices. The engineer's function is that of design and supervision only. If the engineer's estimate is to be final, the contractor should simply be invited to accept or reject the work on the engineer's price offered.

The risk is entirely the contractor's and he should be allowed to determine his methods and prices accordingly.

It is inevitable that the experienced contractor derives his unit prices from considerations and from data different, in some cases at least, from the best that the engineer can secure.

The contractor is entitled to, and necessarily must, distribute some items of overhead cost and other general expenses throughout the items bid upon, which do not and cannot include them specifically, although their legitimacy is unquestioned. He may very properly wish to locate a considerable number of them so as to provide for early payment for plant installed, material purchased, or risks involved that the engineer may not, and perhaps cannot taken into consideration in his most careful estimate of direct costs.

The contractor may contemplate methods of executing the work that will greatly increase one item of cost and decrease another and should be entitled to bid in accordance, the sum of the items multiplied by the engineer's estimated quantities being a proper guide for determination of the respective costs of the work by different bids.

In most contracts specific clauses provide that changes may be made and the quantities increased or diminished at the pleasure of the engineer. From this the contractor has no recourse, and considerable changes in the amount of certain quantities or classification of others may be of great importance to him and are more likely to work an injury than to benefit him because they unbalance his schedule and provisions. The engineer is also naturally very cautious in making such changes that will greatly increase the cost to the owner of the work over his estimate, while the saving due to economies on work, which may necessarily involve a large outlay for plant installation or a corresponding diminution of the contractor's legitimately anticipated profits, are not objectionable to his employers.

The danger of serious injustice to the owner through the operation of an unbalanced contract is generally very small if the contract, specifications and plans are properly prepared after sufficient investigations, and are efficiently carried out.

Some sort of sliding scale for prices or allowances, rebates or changes should be made for any considerable variation of quantities and for unclassified or indeterminate work, but it should be remembered that the unit allowances for increments or decrements of the estimated quantities should usually differ materially from the original unit prices. When these allowances are properly made they serve as an automatic check and the contractor who insists on unit prices that are too high for any important items

will lose the contract on the merits of his own competitive bid. It, therefore, appears to be both unfair and unnecessary for the engineer to arbitrarily fix unit prices.

Mahomet Goes to the Mountain

With billions of dollars worth of all sorts of construction, especially engineering construction, urgently needed, and with almost unlimited capital and equipment available for it, it is useless to deny that this country is still far behind its proper and necessary degree of activity. The post-war inertia is still potent, and too much of the sorely needed resumption of important enterprises has been of the galvanic nature produced by passing the buck to the government and creating a large volume of public work, especially highway construction. This, while undoubtedly serving as a tonic, does not sufficiently nourish the great national industrial and commercial system until the adjustments of labor and prices are complete enough to reassure capital which must be relied upon to carry out the numberless enterprises and improvements that must soon gather momentum for years of unexampled prosperity.

Meantime it is still such a rocky road to prosperity and so costly waiting, that determined spirits are hastening to meet prosperity rather than wait for its delayed advance. The courage and foresight which will anticipate and create present opportunities will be safely launched to ride on the crest of the coming wave instead of being swamped by it, and the apparent risk of a judicious investment carefully planned and conserved will disappear with its profitable execution.

This is particularly true of various public utilities of the non-imperative type that tend to beneficial developments and to greater convenience, the use of which is optional with the public, but which have a real economic value. It may be impossible to secure the appropriation of public funds for them at the present time and difficult to underwrite them in the open market, but when individuals with ample resources and experience undertake such a project with full knowledge of the details, it is to be presupposed that the enterprise is sound, and while the public is the beneficiary, no interest or individual is injured or seriously jeopardized and the promoters are due to receive a well deserved reward.

While the \$100,000,000 mammoth railroad bridge project to span the Hudson River at New York City is slowly progressing with patient private enterprise, active steps have been taken, as noted on page 180, for the immediate construction of another popular Hudson River bridge to form an important link in the highway system of New York State and greatly benefit thousands of automobilists touring the magnificent Hudson valley.

Although the proposed span is slightly longer than that of the greatest of the three huge suspension bridges between New York and Brooklyn, the comparatively light design necessary for automobile traffic only, reduces the weight and cost of the bridge to a fraction of that for carrying multiple railroad tracks. The experience and high development that have been attained in the art make both design and construction a comparatively simple matter, especial-

ly under the favorable conditions and location selected by the promoters, who are experienced practical bridge builders, successful in many previous large enterprises.

Lincoln Highway

During 1921, 297 miles of the Lincoln Highway have been completed at a cost of \$7,737,473, plus a maintenance cost of \$1,735,433 in the eleven states of New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Nebraska, Wyoming, Utah, Nevada and California. The total length of the highway will be, when completed, 3,305 miles, on which \$40,000,000 has been expended during the past 9 years. The classification of types of hard-surface roads includes about 522 miles of concrete, 241 miles of brick, 383 miles of bituminous macadam, 287 miles of stone

macadam, 78 miles of asphalt, 6 miles of creosote block and 7 miles of granite block. The largest amount of new construction done on it last year in any one state was nearly 110 miles in Nebraska.

Taxing Gasoline for Road Work

The taxing of gasoline as a means of raising funds for highway work has been adopted by a number of states as the most convenient and practicable method of assessing funds on automobile users in proportion to the amount of use they make of the roads. Wisconsin is proposing to impose a tax of one cent on each gallon of gasoline sold in the state, which, it is estimated, would bring in a revenue of one and one-quarter million dollars. So far as we have kept track of the legislation, about a dozen states are now taxing oil as a means of raising highway funds.

Table No. 3—Methods of Paying for Paving—Continued

Name of City	Percentage of Paving Cost		Method of Calculating Assessments.	Payable in how many instalments.	Funds obtained by city by	Life of bonds, years.
	Assessed on abutting property.	Paid by city.				
Ohio—Continued						
Nelsonville	98%	2%	Front ft., excl. intersections.	10-20	bonds	10-20
New Boston	all	.....	Front ft., excl. intersections.	15	bonds	15
Niles	98%	2%	Front ft., excl. intersections.	10	bonds	10
Oberlin	98%	2%	Front ft., excl. intersections.	10	bonds	10
Salem	98%	2%	Repav. 50-50. Front ft., excl. intersections.	10-20	bonds	10-20
Sandusky	98%	2%	Front ft., excl. intersections.	10	bonds	10
Sidney	all	.....	Front ft., excl. intersections.	10	bonds	10-20
Toledo	98%	2%	Benefits based on frontage, intersections by city.	5	bonds	10-30
Urbana	98%	2%	Front ft., excl. intersections.	10	bonds	10
West Park	98%	2%	Front ft., excl. intersections.	10	bonds	30
Wooster	98%	2%	Front ft., excl. intersections.	10	bonds	10
Zanesville	98%	2%	Front ft., excl. intersections.	5	bonds	5
Oklahoma:						
Ada	all	.....	Chgd. to lineal ft. served.	10	.....	..
Hugo	all	.....	By front ft. and ¼ block.	10	budget	..
McAllister	all	.....	Front ft. (See note.)	..	.....	10
Sapulpa	all	.....	Front foot.	10	.....	10
Shawnee	75%	25%	By area.	10	budget	10
Oregon:						
Astoria	all	.....	Benefit basis.	up to 20	.....	..
Baker	100%	.....	Area of lot.	10	bonds	20
Eugene	all	.....	Front ft., excl. intersections.	10	bonds	10
Klamath Falls..	100%	.....	Area of lot.	10	.....	10
La Grande	all	.....	Front ft. and intersection zones.	10	.....	10
Oregon City ...	all	.....	Replacements by city. Front ft.	10	budget	..
Portland	all	.....	.....	20	.....	..
Salem	all	.....	By front ft. and in zones.	semi-annual	bonds	10
Pennsylvania:						
Ashley	¾	¼	Front foot.	..	both	20
Beaver Falls ..	¾	¼	Front ft., incl. intersections.	..	both	30
Berwick	¾	¼	Front ft., incl. intersections.	..	bonds	30
Carrick .....	.....	.....	Front ft. and area of lot.	4	bonds	25
Chester	all	.....	Front ft., excl. intersections.	10	budget	..
Clearfield	all	.....	Alleys ½ city, ¾ prop.; front ft., excl. intersections.	6 mos.	bonds and taxes	..
Connellsville ...	all	.....	Front ft., city intersections.	..	both	5
Du Bois	¾	¼	Front foot.	lump sum	both	20
Duquesne	all	.....	Acc. to benefits.	1	.....	15-25
Farrell	¾	¼	Front ft., excl. intersections.	..	bonds	..
Franklin	all	.....	Benefits and damages, intersections by city.	..	bonds	..
Freeland	¾	¼	Front ft., excl. intersections.	3-5	both	10-20
Greensburg	¾	¼	Front foot.	..	bonds	..
Greenville	¾	¼	Front foot. Sheet asphalt, all by owners but intersections.	..	budget	..
Hazleton	¾	¼	Front foot.	..	budget	..
Huntingdon ...	¾	¼	Front ft., excl. intersections.	..	bonds	..
Kane	all	.....	Front ft., excl. intersections.	..	budget	..
Kingston	¾	¼	Front foot.	..	both	short term
Lebanon	all	.....	Front ft., excl. intersections.	5	bonds	15
Monongahela ..	¾	¼	Front ft., excl. intersections.	..	bonds	..
Munhall	¾	¼	Foot frontage.	..	bonds	20
Norristown .....	.....	.....	Front ft., excl. intersections.	1	bonds	30
North Braddock	¾	¼	Front foot.	2	bonds	2
Oil City	all	.....	Front ft., excl. intersections.	5	both	5-20
Parkersburg ..	all	all	Repav.—all by city.	..	budget	..
Pittsburg	¾	¼	Cement by prop.	2	both	30
Pottstown .....	.....	¼	Front foot.	1	both	30
Pottsville .....	.....	all	Front ft., excl. intersections.	..	bonds	..
Rankin	¾	¼	Front foot.	1	bonds	..
Sewickley	¾	¼	Front foot.	3	budget	..
Shippensburg ..	none	.....	State and borough.	..	bonds	20
St. Marys	¾	¼	Front foot.	..	bonds	15
Swoyerville	¾	¼	Front foot.	3	bonds	20

Methods of Paying for Paving—Continued

Name of City	Percentage of Paving Cost		Method of Calculating Assessments.	Payable in how many instal-ments.	Funds obtained by city by	Life of bonds, years.
	Assessed on abutting property.	Paid by city.				
Pennsylvania—Continued						
Tyrone	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., incl. intersections.	..	both	30
Uniontown	$\frac{2}{3}$	$\frac{1}{2}$	Front ft.	..	both	30
W. Homestead .....	.....	all	Curb by prop.	..	.....	5
Wilkes-Barre .....	.....	.....	Per front foot base.	10	both	30
Wilkesburg	$\frac{2}{3}$	$\frac{1}{2}$	Front foot.	..	both	30
Williamsport	all	.....	Intersections by city.	10	both	10
York	all	.....	Intersections by city.	10	bonds	10
Rhode Island:						
Pawtucket .....	.....	all	.....	..	notes	..
Westerly .....	.....	all	.....	..	budget	..
Woonsocket .....	.....	all	.....	..	.....	..
South Carolina:						
Charleston	all	.....	Front ft., incl. pt. of st. inter-section.	10	certificates	10
Chester	50%	50%	By front foot.	10	bonds	30
Columbia	50%	50%	By front ft., excl. intersections.	..	bonds	20
Greenville	$\frac{1}{2}$	$\frac{1}{2}$	Front foot.	..	bonds	20-40
Spartanburg	50%	50%	Front ft., excl. intersections.	5	bonds	20
South Dakota:						
Mitchell	all	.....	Front ft., excl. intersections.	10	.....	..
Tennessee:						
Clarksville	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., excl. intersections.	10	bonds	10-20
Cleveland	$\frac{2}{3}$	$\frac{1}{2}$	Front foot.	5	bonds	20
Jackson	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., incl. intersections.	10	bonds	10
Johnson City	85%	15%	On valuation of lot.	10	bonds	20-30
Texas:						
Amarillo	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., incl. intersections.	5	bonds	30
Beaumont	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., excl. intersections.	..	bonds	20-40
Bonham	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., excl. intersections.	10	bonds	..
Cameron	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., incl. intersections.	..	bonds	30
Cisco	$\frac{3}{4}$	$\frac{1}{2}$	Front foot.	3	bonds	40
Corpus Christi	$\frac{3}{4}$	$\frac{1}{2}$	Frontage, excl. intersections.	5	bonds	40
Dallas	all	.....	Frontage, excl. intersections.	6	both	40
Denton	$\frac{2}{3}$	$\frac{1}{2}$	Frontage, incl. intersections.	3	bonds	40
Eastland	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., excl. intersections.	3	bonds	40-20
Fort Worth	all	.....	Front ft., excl. intersections.	3	both	30-40
Mineral Wells	$\frac{2}{3}$	$\frac{1}{2}$	Front ft., excl. intersections.	3	bonds	20-40
Texarkana .....	.....	all	.....	..	bonds	20
Waxahachie .....	.....	$\frac{1}{4}$	Front foot.	5	bonds	40
Wichita Falls	$\frac{1}{4}$	$\frac{1}{4}$	Front foot.	3	bonds	30
Utah:						
Logan	all	.....	Front ft., excl. intersections.	10	budget	..
Vermont:						
Barre	$\frac{1}{2}$	$\frac{1}{2}$	Front ft., excl. intersections.	5	budget	..
Rutland .....	.....	.....	.....	..	bonds	4
Springfield .....	.....	all	.....	..	budget	..
Virginia:						
Charlottesville .....	.....	all	.....	..	both	..
Danville .....	.....	all	.....	..	bond	25
Fredericksburg .....	.....	all	Sidewalks by prop.	..	budget	..
Newport News .....	.....	all	.....	..	bonds	30
Norfolk .....	.....	all	.....	..	bonds	20-15
Petersburg .....	.....	all	Sidewalks only assessed.	1	both	40
Salem .....	.....	all	.....	..	bond	..
Suffolk .....	.....	all	.....	..	bonds	10-20
Washington:						
Bellingham	all	.....	Area of lot. (See Note).	5-10	.....	6-12
Chehalis	all	.....	Area, incl. intersections.	10	none	10
Dayton	all	.....	Area in zones.	10	.....	12
Okanogan .....	.....	.....	.....	10	both	10
Puyallup	all	.....	Front ft., incl. intersections.	10	.....	12
Raymond	all	.....	Zone method, intersections as-sessed to district.	..	budget	10
Seattle	all	.....	By area in zones.	10	budget	..
West Virginia:						
Bluefield	75%	25%	Area, excl. intersections.	3	budget	..
Fairmont .....	.....	$\frac{1}{2}$	Front ft., excl. grad. & intersect.	1	budget	..
Parkersburg	all	.....	Front ft., excl. intersections.	10	bonds	10
Wheeling	$\frac{2}{3}$	$\frac{1}{2}$	Front foot.	10	bonds	35
Wisconsin:						
Appleton	all	.....	Front ft., excl. intersections.	5	budget	..
Cudahy	all	.....	Front ft., excl. intersections.	5	budget	..
Delavan	all	.....	Benefits to lot, excl. intersections.	10	budget	..
De Pere	all	.....	Front ft., excl. intersections.	10	budget	..
Edgerton .....	.....	.....	Benefits, all grad. by city,	5	both	..
Fond du Lac .....	.....	.....	% intersections.	..	..	..
Green Bay	all	.....	Actual cost up to \$3 yd.	5	budget	5
Kaukauna .....	.....	.....	Front ft., excl. intersections.	5	budget	..
Lake Geneva	33 $\frac{1}{2}$ %	.....	Front foot.	1	both	5-10
Madison .....	.....	.....	Part by county. Front foot.	10	both	5-10
Manitowoc	50%	50%	Prop. up to \$6 per ft. City all	10	bonds	10
Marshfield	all	.....	above. Ft. front., excl. intersect.	5	bonds	20
Milwaukee .....	.....	.....	Front ft., excl. intersections.	5	budget	..
New London	$\frac{2}{3}$	$\frac{1}{2}$	Assessed up to \$3 per sq. yd.	6	budget	..
Oshkosh .....	.....	.....	Above that 50% by city.	..	..	..
Sheboygan	all	.....	By sq. ft., excl. intersections.	3	both	10
Sparta	$\frac{2}{3}$	$\frac{1}{2}$	.....	5	both	1-5
Superior	all	.....	Front ft., benefits & damages;	5	budget	..
Waukesha .....	.....	.....	intersection by city.	..	..	..
Wausau	50%	50%	Front ft., excl. intersections.	5	bonds	1-5
Wisc'sin Rapids	$\frac{2}{3}$	$\frac{1}{2}$	Front foot.	5	general funds	5
Wyoming:						
Casper	all	.....	Front foot or benefits & damages.	10	.....	10
Sheridan	all	.....	Foot frontage.	..	budget	..
			Front ft., excl. intersections.	1	bonds	5
			Area of lots acc. of zoning system	10	both	10
			Area & zone.	10	bonds	10

Recent Legal Decisions

EFFECT OF RESERVATION OF RIGHT "TO REJECT ANY AND ALL BIDS"

Where both the state statute providing for an award of public works to the "lowest responsible bidder" and the notice published for bids reserved the power to the commissioners' court authorized to let the construction of a highway bridge to "reject any and all bids," the Texas Court of Civil Appeals holds, *Holt & Co. v. Wheeler County*, 235 S. W. 226, that this was notice to any intending bidder that the commissioners' court was not obligated to accept any bid that might be made or to award any contract thereon unless the court deemed the bid the lowest and the bidder satisfactory and adjudged the acceptance thereof to be for the best interests of the county. The proposal bound neither party, and neither party acquired a right against the other. The advantage to the bidder is no part of the design of the statute, and no such right is created in his favor as forms the subject of an action at law or of a suit in equity.

Under the terms of the statute, it was held that the commissioners' court might, in its discretion, reject the lowest bid and award the contract to another bidder on the ground that this would serve the best interests of the county. And where the state highway engineer appointed by the state highway commission threatened not to give the county financial aid if the highway contract was awarded to the lowest bidder, the rejection by the commissioners' court of the lowest bid and the acceptance of a higher bid was held not an abuse of discretion.

DIVISION OF LARGE STREET RAILWAY SYSTEMS INTO SEPARATE ACCOUNTING DISTRICTS WITH DIFFERENT RATES OF FARES

In reducing street railway fares of the Connecticut Company within the limits of the city of Bridgeport from 10 cents to 5 cents for a test period of ninety days, the Connecticut Public Utilities Commission says, November 12, 1921, that, while large centres of population should assist in supporting the tributary lines having to do with the social, business, and industrial activities of the community, they should not be called upon to assist in the maintenance of street railway service in remote sections of the state. The system of a railway covering a large territory should be divided into separate accounting districts, each district to comprise such territory and municipalities as are closely connected with each other and are daily dependent in their social, business, and industrial activities upon intercommunication and transportation, each district to be self supporting and allow the company a fair return on the value of the plant and equipment therein located and used, the rates of fare to be so adjusted as to afford such return, irrespective of what the rates may be in other districts.

TRIALS OF CHARGES AGAINST MUNICIPAL OFFICERS OR EMPLOYEES NOT SUBJECT TO RULES GOVERNING JUDICIAL TRIBUNALS

The California District Court of Appeals, Third District, in *Butler v. Scholefield*, 201 Pac. 625, holds that trials of charges against an officer or employee of a municipality or county are not controlled by or subject to the rules that appertain to judicial tribunals, where the Legislature has expressly given the governing body of the municipality or the county the exclusive cognizance or jurisdiction of such trials, and the law creating such body the exclusive tribunal by which such trials should be had makes no provision for disqualifying a member from acting upon the ground that he is biased or prejudiced against the officer or employee on trial. This, the court considers is sustained by the greater weight of authority, though there are cases holding that municipal boards in proceedings for removal act judicially, and that therefore those boards whose members prefer the charges are disqualified from sitting as members of the council or board on hearing them, since they cannot act both as accusers and judges.

MUNICIPALITY'S POWER TO PURCHASE ESTABLISHED WATER SUPPLY SYSTEM

Under the provision of the California Municipal Incorporation Act, permitting cities of the sixth class to acquire and construct water supply systems, and notwithstanding the provision therein prohibiting the levying and collection of property tax in excess of \$1 on each hundred without the assent of two-thirds of the electors, and the section prohibiting trustees from incurring a liability in excess of the available money in the treasury legally apportioned and appropriated therefor, it is held, *Kane v. Wedell*, (Cal.) 202 Pac. 340, that a city of the sixth class could purchase and establish a water supply system under the Public Utilities Act of 1913, and levy an assessment on the property of owners within the city to furnish the purchase money.

TAXPAYER HELD NOT ENTITLED TO INTERVENE IN SUIT BY CITY

A taxpayer cannot intervene in an action by a city to enforce rates for light and power lower than the rates a light and power company insists it has the right to charge. The Michigan Supreme Court *City of Grand Rapids v. Consumers' Power Co.*, 185 N. W. 852, holds that the taxpayer's contention that if the suit were continued he with other taxpayers must bear the burden and pay the expenses, and therefore he had a right to be heard in the suit could not be sustained, otherwise taxpayers might intervene in all suits brought by the city because they were paying the bills. In litigation brought by a city the taxpayer is heard through the accredited representative of the city, the city attorney.

NEWS OF THE SOCIETIES

CALENDAR

March 14—**SOCIETY OF INDUSTRIAL ENGINEERS.** Auditorium Hotel, Chicago.

March 14—**ENGINEERING SOCIETY OF BUFFALO.** Engineers' Club. Secretary, N. L. Nussbaumer, 80 West Genesee St., Buffalo.

March 14-16—**INTERNATIONAL GARDEN CITIES AND TOWN PLANNING ASSOCIATION.** International conference. London, England.

March 14-16—**AMERICAN RAILWAY ENGINEERING ASSOCIATION.** Annual convention. Chicago, Ill.

March 15—**NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.** Engineering Societies Bldg., New York City.

Mar. 15—**METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.** Joint meeting with A. I. E. E., A. S. C. E. and A. S. M. E. Engineering Societies Bldg., New York City.

March 18—**ROCHESTER ENGINEERING SOCIETY.** Quarter-centennial dinner.

Mar. 20—**CONNECTICUT STATE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.** Spring meeting. Taft Hotel, New Haven.

Mar. 21—**PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.** Hydro-electric symposium.

March 22-23—**INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.** 15th annual convention. Claypool Hotel, Indianapolis.

March 22-23-24—**IOWA ROAD OFFICIALS.** Tenth annual conference State Highway Commission's office, Ames, Ia.

March 29-30—**ILLINOIS SECTION, AMERICAN WATER WORKS ASSOCIATION.** Fourteenth annual meeting. Urbana, Ill.

Apr. 3-5—**NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES.** Drake Hotel, Chicago.

April 19-21—**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.** General meeting. Chicago, Ill.

April 19-21—**TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA.** Spartanburg, S. C.

April 27-30—**BUILDING OFFICIALS' CONFERENCE.** April 27-28, Cleveland, O.; April 29, Massillon, O.; April 30, Youngstown, O.

May 15-19—**AMERICAN WATER ASSOCIATION.** 42d Annual Convention, Bellevue-Stratford Hotel, Philadelphia. Secretary, J. M. Diven, 153 W. 71 St., New York.

June 4-6—**AMERICAN ASSOCIATION OF ENGINEERS.** 8th Annual Convention. Salt Lake City, Utah.

June 13-16—**CANADIAN GOOD ROADS ASSOCIATION.** Annual convention. Victoria, B. C.

JUNE 26-July 1—**AMERICAN SOCIETY FOR TESTING MATERIALS.** 25th annual meeting. Chalfonte-Hadden Hall Hotel, Atlantic City, N. J.

Sept. 25-28—**SOUTHWEST WATER WORKS ASSOCIATION.** Annual convention. Hot Springs, Ark.

Oct. 9-13—**AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS.** Annual convention. Cleveland, Ohio.

NEW ENGLAND WATER WORKS ASSOCIATION

The March meeting of this association will be held at the Boston City Club March 14.

Programme—Morning—Meeting of Executive Committee at the head-

quarters, Tremont Temple. Luncheon served at the Boston City Club.

Afternoon—"The Corrosion of the 36-in. Steel Main at Akron, Ohio," by G. Gale Dixon. (Illustrated.) "Investigation of Electrolysis of Steel Force Main at Akron, Ohio," by Victor B. Phillips. (Illustrated.)

These two papers will furnish valuable information in reference to the corrosion of steel mains by stray currents. Mr. Dixon will describe general conditions at Akron, and summarize corrosion results in other steel mains; Mr. Phillips will give in detail an account of the electrolytic survey and the solution of the problem at Akron.

Time permitting, discussion will be had on one of the following practical subjects:

"Carrying Cast Iron Pipes Through Foundation Walls."

"Use of Extension Stems Over All Street Gates."

"Operation of Distribution System with Valves Partially Closed."

ENGINEERING SOCIETY OF BUFFALO

The March 14 meeting of the Engineering Society of Buffalo will be addressed by Col. E. Lester Jones, director of the U. S. Coast and Geodetic Survey and Commissioner of the International Boundary, United States-Canada, on "Surveying from the Air."

IOWA HIGHWAY OFFICIALS CONFERENCE

The conference of the Iowa Highway Officials scheduled for a three-day session at Ames, March 22, 23, 24, will be in the nature of a short course in highway construction, maintenance and administration in which not less than 450 officials are expected to participate.

There are approximately 650 supervisors, engineers and auditors, all of whom are actively concerned in directing road work from an administration or engineering standpoint. There are approximately 6,500 township trustees and clerks who are in charge of the township road work. The invitation is extended to all officials, state, county and township, to come prepared to take part in the conference. The work of the conference will be organized much like a college short course.

There will be sessions devoted to road maintenance, to grading, drainage, graveling, hard surfacing, secondary road improvement projects and the like. Those engineers or officials whose work has been most successful along each particular line or who have had most experience in handling that particular type of work, will be placed on the program to open these especial

topics. Others with similar experience will be scheduled to follow with discussion of the topic as presented, or with ideas from their own experience. The discussion will then be thrown open for full participation by all in attendance.

Every discussion is carried on with the idea of bringing out the best means and methods of getting the work in hand done quickly, economically and satisfactorily. Problems in administration, contracting, uniform cost accounting and methods of keeping road building records will be conducted in the same manner.

While most of the meetings are joint sessions, separate meetings will be scheduled for the auditors, supervisors and engineers, at which they will take up the especial problems which confront them and which are not of especial interest to the other officials. Each division will arrange its own program for discussion and conduct its own meeting.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

A meeting of the Baltimore section of the American Society of Mechanical Engineers was held at the Engineers' Club on March 8. This included a morning trip around the harbor, an afternoon session on "Material Handling and Harbor Development," and in the evening a banquet with addresses on subjects of general interest, at which W. W. Pagon presided.

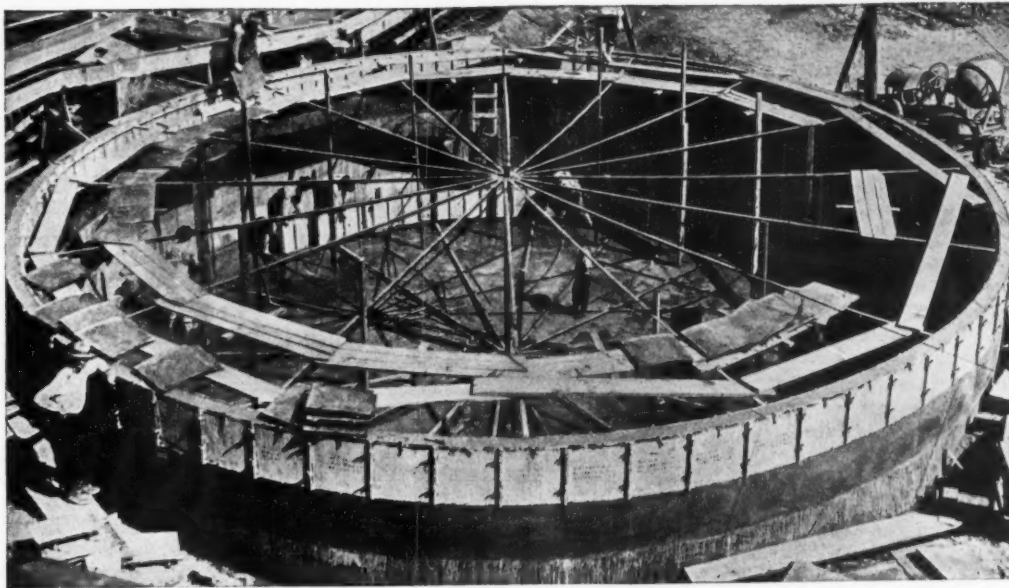
The Colorado section held a meeting on March 10 at the Metropole Hotel, Denver, which was addressed by C. H. McClintock of the Denver Tramway Co., on "The Power Situation of the Denver Tramway."

The Connecticut State section has two meetings scheduled: one on March 11 to discuss the affiliation of the technical societies of Connecticut, and one on March 20 on "The Human Element in Industry." The speakers at the meeting are J. J. Callahan, president of the Employees' Representation Service, New York City; J. E. Bennett and President Dexter S. Kimball. Both of these meetings will be held at New Haven.

The Philadelphia section will hold a hydro-electric symposium on March 21 at the joint meeting of the Engineers' Club of Philadelphia, sections of the A. I. E. E., A. S. C. E. and A. S. M. E. with the co-operation of the Hydro-Electric Power Commission of Ontario, Sir Adam Beck, chairman. Discussion will be held on the actual operation of the Chippewa Queenston Development of the Hydro-Electric Power Commission of Ontario with special reference to the 55,000 H.P. water wheels put in operation in January.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



CONCRETING LARGE TANK WITH METAFORM CORPORATION'S INTERCHANGEABLE FLANGED, CLAMPED AND DOWELED STANDARD UNITS

FLAT AND CURVED FLANGED STEEL FORMS

Metaforms manufactured by the Metal Forms Corporation, consist of interlocking, interchangeable steel units, flange connected together to build up forms for many different kinds of concrete construction. The standard rectangular unit for flat surfaces is a 24 x 24-inch panel of 16-gage steel with 1 x 1-inch flange angles on all four sides and a cross angle to stiffen it in the center. Dowel pins are set in the sides to align it and clamps provided to hold the flanges in place are locked or unlocked by a single push.

Metaforms for circular construction are also made with 16-gage sheet steel and 1 x 1-inch flange angles and are

strengthened on the center by a 1-inch flat bar parallel to the axis of the cylinder to which the sheets may be sprung. Each unit is aligned by means of two dowels, and is furnished with two clamps, riveted on, that engage rivet heads in the adjacent units. They are handled by a center erection mast with fittings, to keep it in alignment, and the mast is provided with a radial arm and two tip buckets, which are alternately hoisted by the derrick and revolved to position horizontally and emptied into the form. Adjustable forms are provided for conical roof construction.

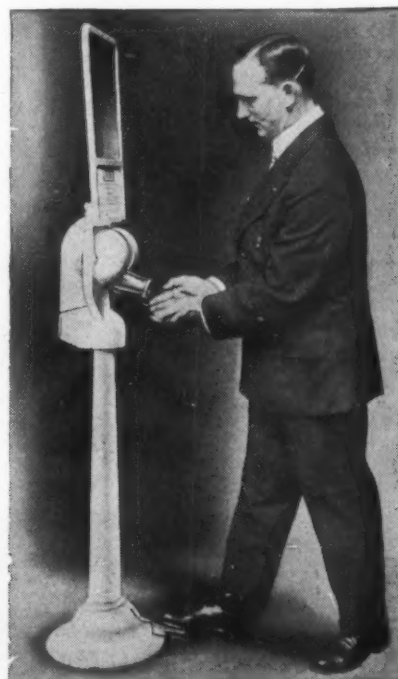
A combination of cylindrical and conical forms with standard units and very few of them are listed for making manholes of various diameters.



METAFORM CORPORATION'S STANDARD ADJUSTABLE UNIT FORMS FOR MANHOLES

AIRDRY ELECTRIC TOWEL

The Airdry Corporation, manufacturer, has issued a leaflet describing automatic electric appliance for installation in lavatories, public buildings, comfort stations and other places for the elimination of cloth and paper towels in drying the hands. It is made in several patterns of enameled iron, mounted on



AIRDRI CORPORATION'S ELECTRIC TOWEL APPARATUS FOR LAVATORIES

the wall or on pedestals and is easily installed by providing a circuit of not smaller than No. 14 B and S. A. G. A. wire, with the nearest junction box. It consists of a standardized universal motor, fan and heating coil, is controlled by a foot pedal, and is guaranteed for one year. It consumes $1\frac{1}{2}$ kw. per hour that is sufficient for 100 drying operations, and discharges hot air through an adjustable nozzle, causing evaporation and drying thoroughly without possibility of chapping face or hands. It is claimed to be absolutely sanitary and beneficial and costs only about one-tenth as much as towel service.

ARCHER JUNIOR MIXER

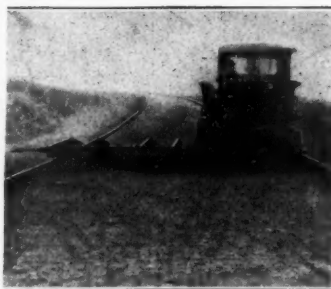
The latest addition to the line of concrete mixers, manufactured by the Archer Iron Works, has a batch capacity of 3 cubic feet of wet concrete and is called the new Archer Junior Mixer. It is built along the same general lines of design as the No. 1 Special and 1-bag mixers and embodies the same features of quick loading, portability and end discharge. It is sturdy and reliable with a low operating and maintenance expense and is equipped with a Fairbanks-Morse Bosch magneto $1\frac{1}{2}$ -h. p. engine.

A very compact arrangement is made by installing the engine on top of the frame enclosing the mixing drum, thus not only saving space but locating the moving parts where they are in the least danger of disturbance. Considerable advantage is claimed for the low loading platform that is supported on an extension of the mixer frame and permits aggregate to be wheeled onto it and then dumped directly into the hopper, providing an elevation high enough for the drum

to discharge into carts or wheelbarrows or onto the surface of the ground, or in many cases to be backed up and discharged over the edge of the form without involving any handling of the concrete. Although conservatively rated at 3 cubic feet the drum has sufficient capacity to take care of $\frac{1}{2}$ -bag mix on almost any proportion of aggregate material. The machine, including the loading platform, is quoted at \$275 f.o.b. Chicago.

BLAW-KNOX TRUCK TURNABLES

The truck turntable made by the Blaw-Knox Co. has a capacity to handle trucks up to 5 tons, and is so compact that it may be placed between the forms on the subgrade for an ordinary width concrete road and still leave clearance for trucks to pass it between the forms, while its own di-



BLAW-KNOX CO.'S TRUCK TURNABLE

mensions are such that it revolves clear of the top of the forms. A steel runway to receive the wheels and support the truck is mounted on a circular track with diameter less than the width of the truck, that moves on rollers engaging a lower track and the whole is mounted on skids that pro-

vide a foundation for the tracks, spider and pivot pins and enables the complete turntable to be handled as a unit and easily transferred from place to place without injury to the subgrade. It is easily moved by dragging behind a returning empty truck that delivers it to the new position without loss of time or interruption to the paver.

Supports at each end of the turntable prevent the latter from tipping when the truck is driven on it, after which the supports are released by the operating lever, which is then used as a push bar with which one man can revolve a 5-ton truck loaded with 4 yards of material.

The use of this turntable enables the truck to be run at ordinary speed to the point where it is located near the mixer, saves the time otherwise taken to turn the truck and back it perhaps several hundred feet to discharge its load at the mixer, and prevents all confusion of trucks being at the turning point and obstructing the right of way. This reduces time from storage bin to mixer and increases the efficiency of the truck service and of the mixer.

NAYLOR LOCK SEAM SPIRAL PIPE

This pipe, made by the Robertson Bros. Mfg. Co., has a perfectly smooth and accurate interior surface and a special seam that develops strength under pressure and reinforces the pipe, against both internal and external pressure. It can be equipped for slip joints, companion flange, or other styles of connections and is recommended for water supply lines of all kinds, for irrigation, sluicing, and dredging, and for various industrial and commercial and manufacturing purposes. It is made of specially tough steel of 10 to 16-gage in 6 to 24-inch diameters and of lengths up to 40 feet. It can be furnished with a $1/32$ -inch hot dip coating of 99.3 per cent. pure bitumin. The approximate bursting strength in square inches per pound varies from 141 for the 24-inch 16-gage size to 1,000 for the 6-inch 12-gage, with corresponding weights per linear foot of 17.03 and 10.50 pounds.

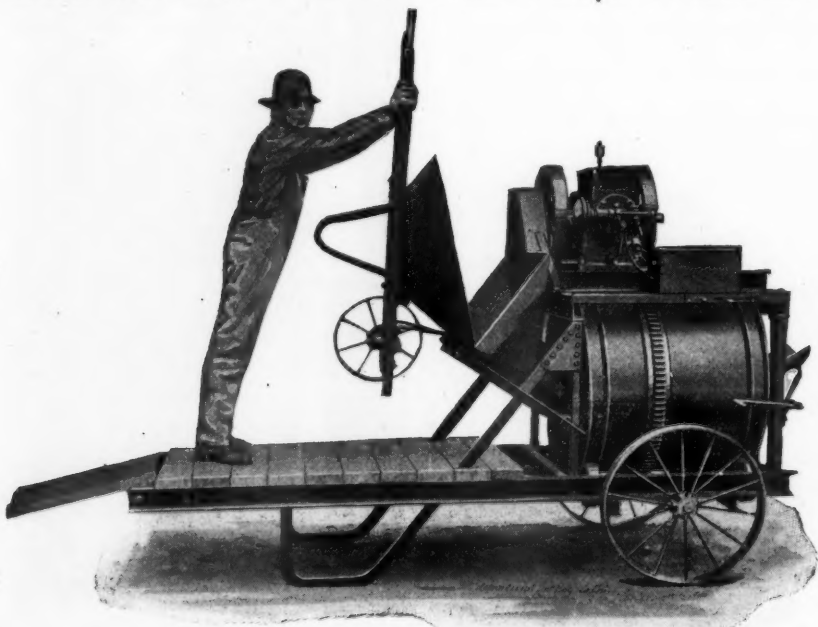
PERSONALS

Whitten, Robert H., of Cleveland, has been appointed consulting engineer for the city plan commission of Indianapolis, Ind., at a salary of \$4,800 a year.

McCurdy, B. C., has been made county highway engineer of St. Clair county, Ill.

Bartlett, A. C., who has been a member of the city planning commission of Los Angeles, Cal., has resigned to become a member of the board of public service commissioners.

Chambers, A. H., city engineer of Logan, Utah, has resigned.



ARCHER JUNIOR CONCRETE MIXER OF 3 CUBIC FEET CAPACITY, WITH LOW LOADING PLATFORM